Chemical & Engineering NEWS
November 5, 1979

Acquisitions have given W. R. Grace the balance it wants Page 10

How the public views hazards in the chemical industry

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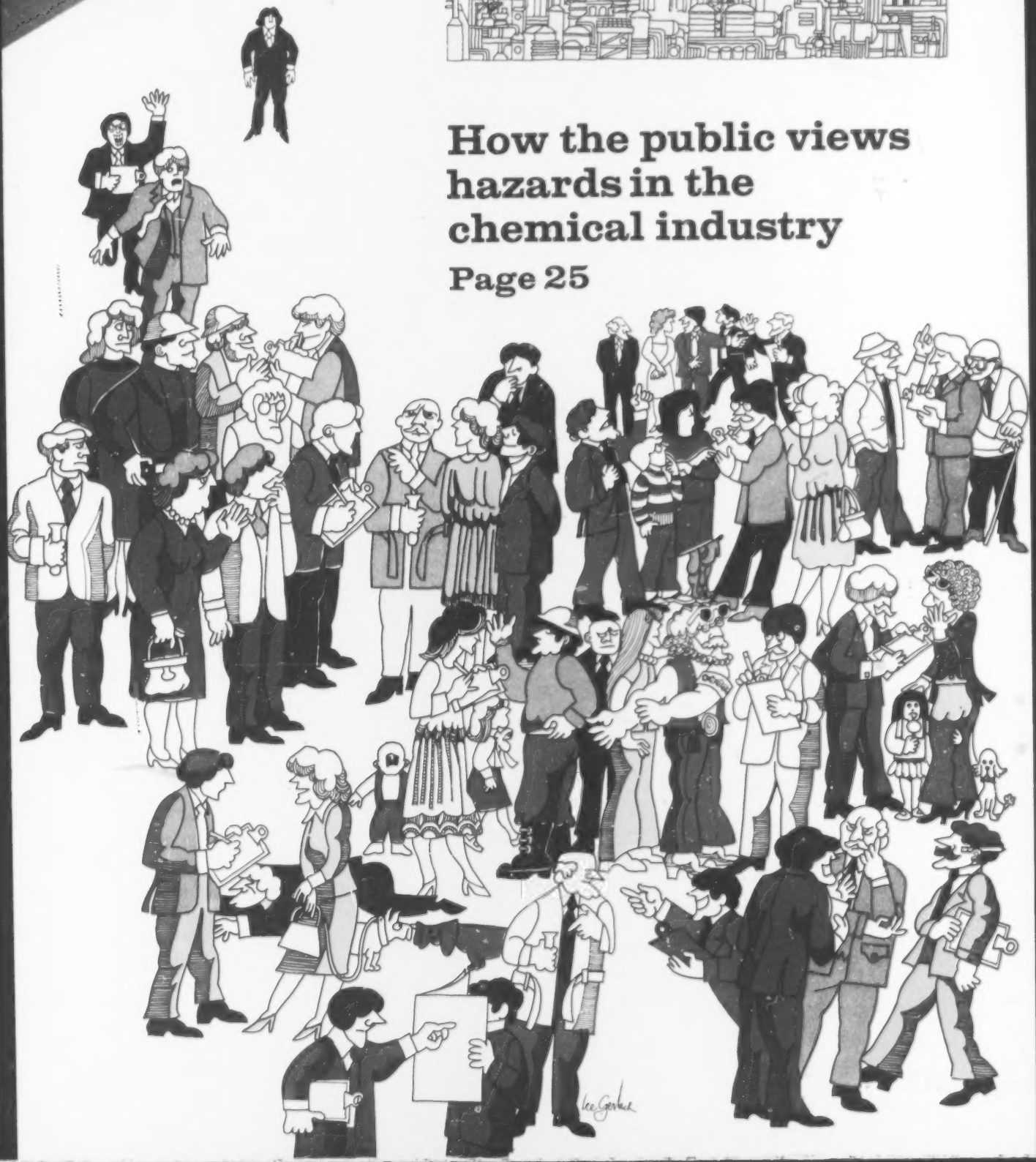

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West European outlook for olefins is mixed

Near-term prospects for both ethylene and propylene are good, but butadiene appears headed for huge surplus of some 1 billion lb by 1985

Ethylene use in Western Europe may grow almost 5% a year up to 1985. But even at that rate, ethylene plants on average will be operating at less than 8% of their nameplate capacity in 1985.

This forecast for ethylene, as well as for other low-molecular-weight olefins was presented by Ronald W. Russell, vice president for petrochemicals at Phillips Petroleum Chemicals' European headquarters in Brussels at the annual meeting of the European Chemical Marketing Research Association held recently in Munich. The meeting was held jointly with the U.S. Chemical Marketing Research Association.

According to Russell, the near-term prospects for propylene in Western Europe look brighter. Demand between 1978 and 1985 will grow 6% per year. In 1985, there is the likelihood of a propylene shortage approaching 300 million lb in contrast to a surplus of almost 300 million lb in 1978, and a surplus of nearly 1.7 billion lb in 1974.

The outlook for butadiene, on the other hand, appears decidedly bleak, he says. Even if consumption grows about 3% per year between 1978 and 1985 as expected, surplus of the chemical in Western Europe in 1985 will exceed 1 billion lb, compared to an excess of 913 million lb in 1978 and of 583 million lb in 1974.

The major share of Western Europe's ethylene goes to make low- and high-density polyethylene. In 1985, ethylene used for local consumption and net exports of these polymers are expected to reach a combined 17.6 billion lb, up from 13 billion lb in 1978, the most recent year for which data are available. Their combined share of total ethylene consumption will continue to be about 53%, Russell says.

Growth of HDPE use in Western Europe will outpace that of LDPE. Between 1978 and 1985, demand for HDPE is forecast to expand at an average yearly rate of 6.4% (from 3 billion lb to more than 4.5 billion lb). Over the same time, LDPE's growth is pegged at a more sober 4.5%-per-year rate (from 8 billion lb to 11 billion lb). Russell expects combined net exports of the two polymers to grow at barely 0.5% annually to 1.8 billion lb in 1985.

Polyvinyl chloride will continue as the second-largest single outlet for European ethylene. In 1985, some 5.5 billion lb of the olefin will be required to make PVC, almost 17% of total ethylene use. Both West European demand and net exports of PVC are expected to grow about 4.5% per year.

Exports of ethylene derivatives from Western Europe far outweigh imports. The ethylene equivalent of exports in 1978 was more than 2.8 billion lb. Of this total, 42% went to countries in the Middle East and Africa, 20% to the Far East, 17% to Central and South America, 16% to Eastern Europe, and 5% to North America.

Imports totaled 460 million lb of ethylene equivalent. Products came from three areas—North America (62% of imports), Eastern Europe (29%), and Japan (9%).

The nearly 2.4 billion lb of net ethylene-equivalent exports last year amounted to just under 10% of Western Europe's consumption. That was down from 13% in 1974. The slide is expected to continue to about 7% in 1985 even though net exports, in volume terms, probably will remain es-

By 1985, West European ethylene consumption may surpass 30 billion lb. . .

Ethylene, millions of lb	1974	1978	1985	% annual growth 1974–78	% annual growth 1978–85
Demand for derivatives	19,745	21,901	30,360	2.6%	4.8%
Net exports of derivatives	2,915	2,376	2,387	−5.0	0.1
Total demand	22,660	24,277	32,747	1.7	4.4
Production	22,660	24,277	32,747	1.7	4.4
Nameplate capacity	27,984	32,329	42,680	3.7	4.1
Utilization rate of ethylene crackers (%)	81%	75%	77%		

. . . propylene may be in short supply. . .

Propylene, millions of lb	1974	1978	1985	% annual growth 1974–78	% annual growth 1978–85
Demand for derivatives	9,482	11,308	17,105	4.5%	6.1%
Net exports of derivatives	1,292	1,727	968	7.4	−8.0
Total demand	10,780	13,035	18,073	4.9	4.8
Production	12,452	13,332	17,776	1.7	4.2
Surplus	1,672	297	(297)		

. . . and butadiene surplus may exceed 1.1 billion lb

Butadiene, millions of lb	1974	1978	1985	% annual growth 1974–78	% annual growth 1978–85
Demand for derivatives	2,431	2,332	2,849	−1.0%	2.9%
Net exports of derivatives	198	242	242	5.1	0.0
Total demand	2,629	2,574	3,091	−0.5	2.6
Production	3,212	3,487	4,213	2.1	2.7
Surplus	583	913	1,122		

Source: Phillips Petroleum Chemicals

Low- and high-density polyethylene takes about half of West European ethylene

Millions of lb	1974 West Europe demand	1974 Net exports	1974 Total ethylene demand	1978 West Europe demand	1978 Net exports	1978 Total ethylene demand	1985[a] West Europe demand	1985[a] Net exports	1985[a] Total ethylene demand
Low-density polyethylene	7,348	1397	8,745	8,272	1067	9,339	11,231	1100	12,331
High-density polyethylene	2,574	572	3,146	2,992	638	3,630	4,609	660	5,269
Polyvinyl chloride	3,333	407	3,740	3,850	187	4,037	5,236	253	5,489
Styrene thermoplastics	1,100	132	1,232	1,265	187	1,452	1,771	187	1,958
Ethylene glycol and other ethylene oxide derivatives	2,596	473	3,069	2,695	275	2,970	3,432	165	3,597
Other products	2,794	(66)	2,728	2,827	22	2,849	4,081	22	4,103
TOTAL	19,745	2915	22,660	21,901	2376	24,277	30,360	2387	32,747

a Estimates. Source: Phillips Petroleum Chemicals

sentially unchanged at about 2.2 billion lb of ethylene equivalent per year through the first half of the 1980's.

Russell doesn't look for any significant rise in the level of imports of ethylene derivatives in the immediate future. Noting that "U.S. producers have enjoyed significant advantages in ethylene costs," he argues that "U.S. exports may be expected to fall as these cost advantages become progressively eroded." Even the much-touted capacity buildup in Eastern Europe is, he notes, primarily being built to satisfy consumer demand there. Should 1985 imports from Eastern Europe rise to 550 million lb annually of ethylene equivalent from 1978's 132 million lb, which, he admits, is likely, the quantity would be less than 2% of the West European anticipated demand that year.

For the longer range, Russell has drawn up two possible scenarios for Western Europe's ethylene business in 1990.

The most optimistic view is that consumption of ethylene derivatives between 1985 and 1990 will grow 4% annually to reach 37 billion lb. Even if net exports, in terms of ethylene equivalent, were to fall to about 1 billion lb from the 2.4 billion lb level anticipated for 1985, this still would put ethylene demand at about 38 billion lb. Barring installation of capacity beyond that expected to be on stream in 1985, units could be operating at about 90% of nameplate capacity levels.

A gloomier view emerges from an alternate set of premises. One is that the rate of consumption of ethylene derivatives will grow at a less buoyant rate of 3% per year to 35.2 billion lb of ethylene equivalent. Another is that Western Europe will become a net importer of ethylene-derived products, perhaps by as much as 2.2 billion lb of ethylene equivalent. In addition, a further 2.2 billion lb of ethylene might be expected to reach Western Europe from producers in the Middle East.

If these factors were to materialize, Russell says, ethylene production in Western Europe would be about 31 billion lb. That level would represent a mere 72% of 1985 capacity.

A big question mark, of course, is the impact of the new ethylene units planned for the Middle East, North Africa, and Turkey. Annual capacity for that region will be about 8.8 billion lb, Russell says.

He estimates that in 1990 demand for ethylene derivatives in the region could consume up to 3.7 billion lb, assuming that per capita consumption matched the level reached in Western Europe around 1967. If the new plants were running at 80% of design capacity, there would be a surplus of some 3.3 billion lb. "This represents over 70% of the combined U.S. and West European exports [of ethylene equivalent derivatives] in 1978," he remarks.

The obvious question is where will the surplus go. Russell believes that countries in Africa and Asia would be the most likely targets for product sales. "Although in Africa south of the Sahara consumption will be modest, the aggregate tonnage of commodity plastics should absorb a reasonable proportion of the surplus," Russell says.

Such sales would encroach directly on established outlets of West European suppliers. And inevitably, some products will find their way into Western Europe. Indeed, Russell foresees the likelihood of some 2 billion lb of ethylene itself being shipped from the new plants to Europe.

Turning to propylene, "demand can be expected to grow in the 1980's at a higher rate than ethylene, probably 1 to 1.5% greater," Russell says. "Toward the end of the 1980's, feedstock supplies to steam crackers could be adjusted if the economics are favorable to allow production of greater quantities of propylene."

From the present propylene surplus position of about 33 million lb, Western Europe likely will move to a deficit of 300 million lb in 1985. By 1990, depending on cracker operations, availability could range from a surplus of 650 million lb to a deficit of 1.4 billion lb.

Western Europe's overall propylene needs exceeded 13 billion lb last year. Requirements for chemicals sold locally amounted to 11.3 billion lb. Well over one third of the quantity went to make polypropylene and acrylonitrile derivatives. Although exports of propylene-based products are expected to decline during the coming decade, demand in Western Europe is expected to grow at an annual rate of 6% to 1985, and 4% annually during the five years after that, according to Russell.

"Butadiene does not show such a rosy picture," Russell notes. "This is mainly due to the poor growth rates of styrene-butadiene rubbers." SBR consumption in Western Europe in 1978 involved use of 1.36 billion lb of butadiene, some 176 million lb less than the quantity in 1974. According to Russell's projection, the 1974 level won't be regained until 1990.

Europe's butadiene needs will grow modestly from the 1978 total of 2.33 billion lb to 2.85 billion lb in 1985, and to 3.14 billion lb in 1990. But the amount going to make synthetic rubbers will take a declining part of the total. Last year, this stood at 85% (2 billion lb). In 1985, Russell believes, the level will be closer to 82% (2.32 billion lb). By 1990, it will slip to about 81% (2.53 billion lb).

Moreover, Europe's exports of butadiene will be hit by the growing trend of U.S. ethylene producers to supplement their natural gas crackers with ones based on petroleum feedstocks that yield coproduct butadiene. Last year, Russell points out, about 880 million lb of the chemical was shipped from Europe, the bulk of it to the U.S. □

Hazards in the chemical industry

The public seems to view the industry as a greater threat to health and safety than do the workers it employs

Rene D. Zentner, Shell Oil

Even a cursory inspection of the press might suggest that the U.S. is in the grip of a rampant cancer epidemic. Reported causes are not hard to find: poisons in the air and water, poisons in food, poisons in the workplace. An examination of the number of accounts of cancer in the news media reveals that they have increased dramatically in the past decade.

Underlying data about the risk of cancer, however, indicate a somewhat different trend. According to the National Cancer Institute, the annual incidence of cancer has in fact been increasing since 1970, but at a rate of only 1 to 2% a year. Overall, trends in national air and water quality also are beginning to improve. Not all chemicals encountered in U.S. daily life, moreover, are likely to cause cancer. The 1977 annual report of the Council on Environmental Quality points out:

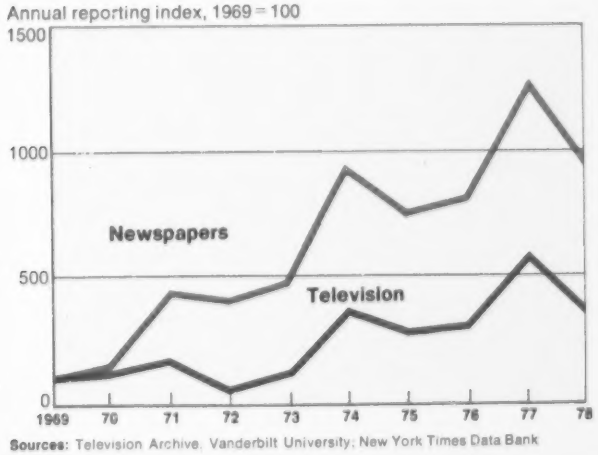
"It is important to note that carcinogenic chemicals are probably a small minority among the 3.5 million known chemicals. About 600 have been tested for carcinogenicity. Many were drugs and pesticides, which by definition are biologically active; less than 10% of the compounds have been found to be carcinogenic. In a random list of chemicals, a still lower percentage may be expected to exhibit carcinogenic activity. Of some 70,000 chemicals in commercial production, the *number* of carcinogens—in particular, the number to which there is widespread population exposure—may be quite small."

Cancer, nevertheless, has been the second greatest cause of death, after heart disease, for the past 40 years in the U.S. But this distinction is a relatively recent one. At the beginning of the 20th century, the three principal disease-based causes of death were heart disease, influenza/pneumonia, and tuberculosis; cancer ran a distant fifth. Since then, the incidence of influenza and pneumonia has been reduced by a factor of almost eight and that of tuberculosis by a factor of more than 100. Thanks to new drugs, they are no longer major killers. No miraculous drug, however, has emerged to conquer heart disease or cancer, whose incidence has risen since 1900.

Even so, there appears to be a discrepancy between increasing public apprehension about cancer, as indicated by news coverage devoted to the disease, and the actual change in risk associated with it.

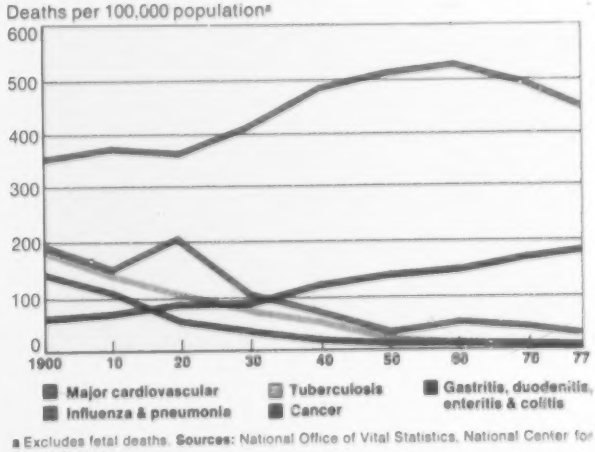
In the light of these developments, how indeed does the

News coverage of cancer is up sharply from decade ago



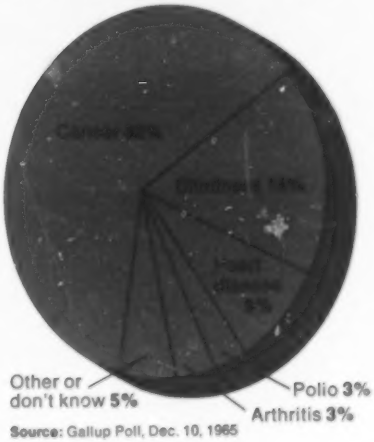
Sources: Television Archive, Vanderbilt University; New York Times Data Bank

Cancer has moved from fifth to second place among deadly diseases



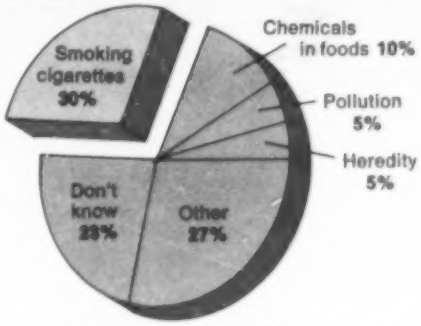
a Excludes fetal deaths. **Sources:** National Office of Vital Statistics, National Center for Health Statistics

Cancer is most-feared disease



Source: Gallup Poll, Dec. 10, 1965

Public views smoking as principal cause of cancer...



What do you think is the major cause of cancer today?

Source: Cambridge Reports Inc., "An Analysis of Public and Worker Attitudes Toward Carcinogens and Cancer Risk"

...and cancer scientists tend to agree

Causative factor[a]	% of U.S. cancer deaths
Environmental	
Cigarette smoking	30-35%
Imprudent diet	30-35
Occupation	1-2
Background radiation	2-4
Nonenvironmental	
Genetic	4-5
Unaccounted for	19-33

a Excludes superficial skin cancer. **Note:** Data are averages for estimates by various scientists at the National Cancer Institute, American Cancer Society, and elsewhere. **Source:** Elizabeth Whelan, "Preventing Cancer," W. W. Norton, New York, 1977

public view cancer and its causes and risks? What is the attitude of the public in general and of workers in the chemical industry regarding the role of chemicals and chemical plants in increasing cancer risks? And what is their opinion with respect to policy issues dealing with exposure to potential carcinogens?

Data pertinent to these questions are available from two types of sources. Syndicated studies like the Gallup Poll and Yankelovich, Skelly, and White's "Corporate Priorities" report are one. Two recent proprietary studies are another. In June 1977, Cambridge Reports surveyed public attitudes toward cancer risks for Union Carbide by means of 1500 personal interviews with a representative sample of adult Americans. The following year, Cambridge Reports made another study for Shell Oil, using a similar public sample but interviewing a sample of 200 chemical plant workers as well.

The Gallup Poll three times since 1947 has asked Americans which disease they dread the most. Each time the question has been posed, cancer has headed the list by a wide margin, although heart disease is responsible for several times as many deaths.

Americans are somewhat more likely to expect to contract some form of cancer than any other disease, including heart disease; this expectation is slightly greater among chemical workers than among the general public.

Cigarette smoking and environmental carcinogens currently are regarded as principal causes of cancer. For at least two decades, a majority of Americans have viewed cigarette smoking as a leading cause of lung cancer by a wide margin. And the margin is increasing. Between 1977 and 1978, the proportion of Americans who regard cigarettes as a major cause of cancer has increased by 12 percentage points to 30%; during the same period the proportion who cannot specify any major cause decreased by 11 percentage points to 23%.

That this perception has a basis in scientific evidence is supported by Dr. Elizabeth Whelan of the Harvard School of Public Health. In her recent book, "Preventing Cancer," she has collected opinions on causes of cancer from a group of scientists working on that disease. These scientists attribute about a third of all cancer deaths to cigarette smoking.

Despite their strong views on cigarettes and other causes of cancer, only about a quarter of Americans believe themselves well informed about cancer and its causes. The 1978 Cambridge Reports study shows that the majority of the public—and a somewhat larger proportion of chemical workers—consider themselves only somewhat informed. Few respondents claim, however, not to know how informed they are about cancer and its causes.

In the past few years, the public has increasingly perceived the chemical industry as a contributor to environmental pollution. Such episodes as the disposal of polychlorinated biphenyls in the Hudson River and of the polychlorinated hydrocarbon pesticide Kepone in the James River have increased public concern about the effects of chemical products on air and water. The revelation of the long-term effects of chemicals buried in the Love Canal area of Niagara Falls, N.Y., has created anxiety in residents of areas where the chemical industry is highly concentrated. It is worthwhile, therefore, to consider how Americans view the industry.

Public attitudes toward the chemical industry's compliance with environmental rules have become more critical in the past five years. The number of people who agree that the industry has done a poor job of observing laws and guidelines on air pollution has almost doubled, rising from 29% in 1974 to 50% in 1978. During the same period, the proportion believing the industry is doing a poor job in complying with water pollution controls has increased from 44% to 54%.

To understand why the chemical industry is singled out as an environmental polluter and a source of threatening substances, consider how the public views pollution. For the past several years, the Yankelovich, Skelly, and White "Corporate Priorities" studies have asked about air pollution. Data from these studies show that the public is increasingly concerned not only about the irritation and discomfort caused by polluted air but also about the health threat it poses to present and future generations. Moreover, waste from chemical plants is considered the most threatening water pollutant.

It should not be surprising, therefore, to find that chemicals also are seen as a cause of cancer. When the 1978 Cambridge study asked the public and chemical workers to choose the principal cause of cancer, chemicals came in second, although a remote second, to smoking, with occupational exposure placing a distant sixth. The data suggest that concern about chemicals is more about chemicals in the environment generally than in the chemical workplace in particular.

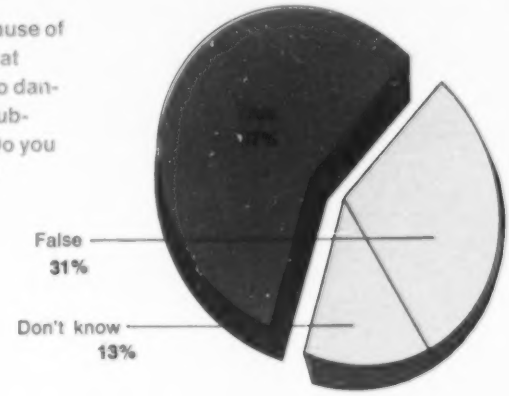
Nevertheless, when asked directly, both groups agree

Majority thinks on-the-job exposure leads to cancer

General public

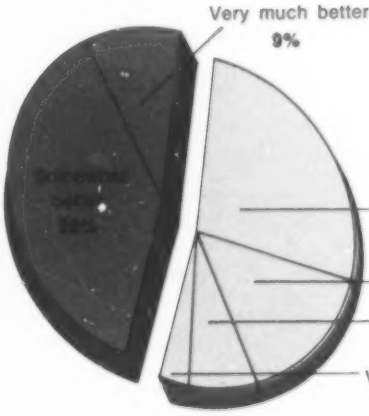
Some people say a key cause of cancer is the exposure that workers have on the job to dangerous cancer-causing substances and chemicals. Do you think this is true or false?

Chemical workers



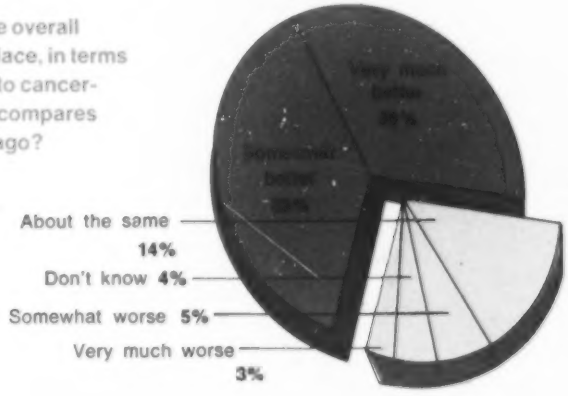
Workers think exposure to carcinogens has been reduced

General public



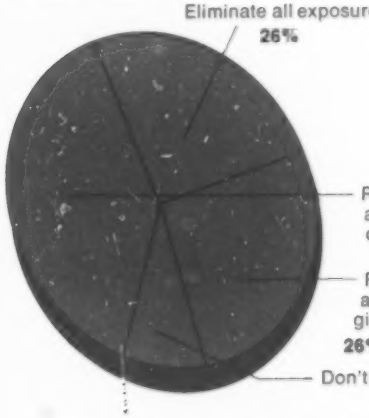
How do you think the overall quality of the workplace, in terms of worker exposure to cancer-causing chemicals, compares now with five years ago?

Chemical workers



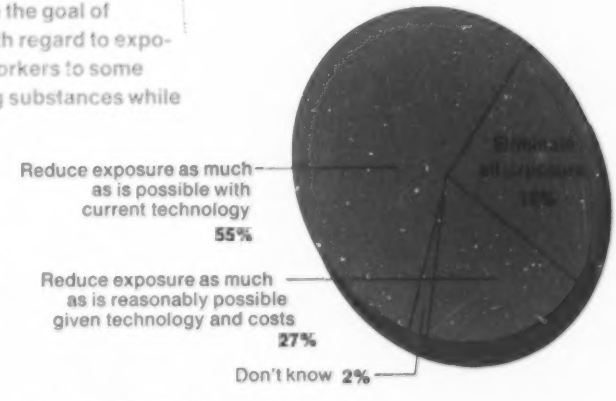
Majority would settle for less than zero on-the-job exposure to carcinogens

General public


Eliminate all exposure
26%
Reduce exposure as much as is possible with current technology 40%
Reduce exposure as much as is reasonably possible given technology and costs
26%
Don't know 9%

What should be the goal of government with regard to exposure of some workers to some cancer-causing substances while on the job?

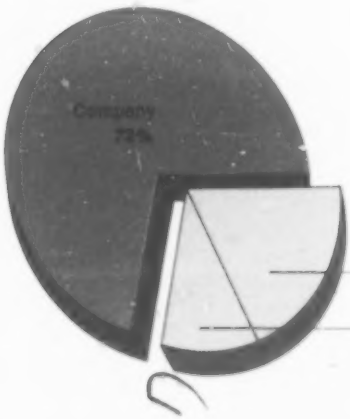
Chemical workers


Reduce exposure as much as is possible with current technology
55%
Reduce exposure as much as is reasonably possible given technology and costs
27%
Don't know 2%

Source: Cambridge Reports Inc., "An Analysis of Public and Worker Attitudes Toward Carcinogens and Cancer Risk"

Companies are seen as responsible for worker safety

General public



Who has the main responsibility for reducing exposure of workers to dangerous substances: the worker himself through wearing protective clothes and devices or the company by designing plants that eliminate exposure?

Worker **18%**

Don't know **11%**

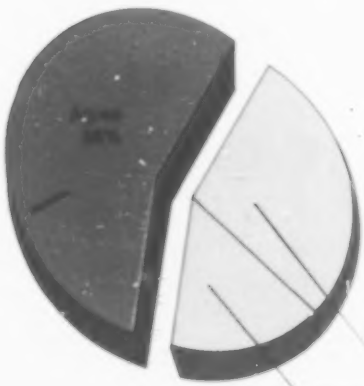
Chemical workers

Worker **20%**

Don't know **12%**

Adequate labeling considered a key to worker safety

General public

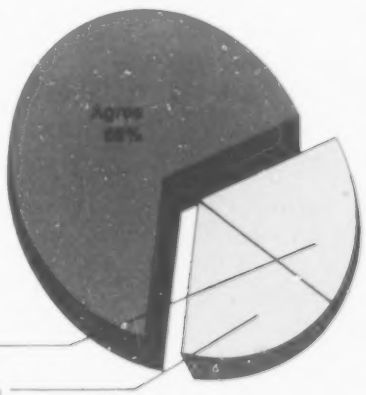


Some people say that the prime responsibility for reducing exposure of workers to dangerous substances rests with the workers themselves, and that all substances in the workplace should be clearly labeled as to their levels of danger and workers then encouraged or forced to be careful with these substances. Do you agree or disagree?

Disagree **29%**

Don't know **15%**

Chemical workers



Disagree **17%**

Don't know **16%**

Opinions vary on who should make decisions on safety/cost trade-offs

General public

If there is a choice between safety and cost in meeting the goal of preventing workers from being exposed to cancer-causing substances, by whom do you think these trade-offs should be made?

Workers, when they decide to work at a particular plant **15%**

Don't know **9%**

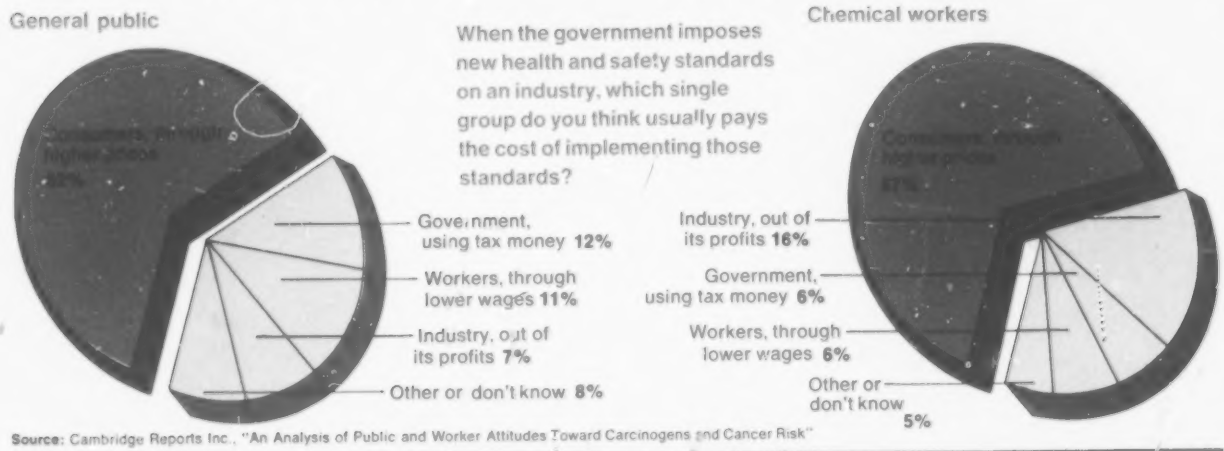
Chemical workers

Workers, when they decide to work at a particular plant **15%**

Don't know **10%**

Source: Cambridge Reports Inc., "An Analysis of Public and Worker Attitudes Toward Carcinogens and Cancer Risk"

Public recognizes that costs of industrial safety fall on consumers


General public
When the government imposes new health and safety standards on an industry, which single group do you think usually pays the cost of implementing those standards?
Chemical workers
Consumers, through higher prices 33%
Government, using tax money 12%
Workers, through lower wages 11%
Industry, out of its profits 7%
Other or don't know 8%
Consumers, through higher prices 67%
Industry, out of its profits 16%
Government, using tax money 6%
Workers, through lower wages 6%
Other or don't know 5%

Source: Cambridge Reports Inc., "An Analysis of Public and Worker Attitudes Toward Carcinogens and Cancer Risk"

that a key cause of cancer is worker exposure to cancer-causing substances. Substantially more workers than public respondents, however, disagree with that proposition.

Three quarters of the general public and 82% of chemicals workers think that employer efforts to promote health and safety in the workplace are good to excellent. About a third of the public and almost half of chemical workers rate employer health and safety efforts excellent; less than a fifth of each group rates them fair or poor.

It should not be surprising, therefore, that the 1978 study found that two thirds of the public and 71% of chemical workers viewed employer efforts as about right and only a quarter of each group thought more effort was needed. Moreover, more than half of the public and more than two thirds of chemical workers believe that workplaces have become safer and more healthful in the past five years.

A substantial difference between public and worker perceptions of worker exposure to carcinogens during the past five years is evidenced by the Cambridge Reports data. Although only 48% of the public sees improvement in the quality of the workplace with regard to such exposure, 75% of chemical workers believes the quality is either somewhat better or very much better. Nowhere in the study does this difference show up more graphically, however, than when the respondents were asked whether or not industry is honestly trying to reduce worker exposure to cancer. Slightly more than a third of the public thinks that industry is trying to reduce such exposure; almost half thinks industry's only concern is making money. However, chemical workers' views ran in the opposite direction, with only 30% contending that making money is industry's sole concern, whereas 60% believes industry is indeed making an honest effort to reduce worker exposure to carcinogens.

These data, taken together, suggest that the chemical industry is increasingly seen not only as a polluter of the environment but also as a source of hazardous wastes that threaten public health. The public generally sees the chemical workplace as dangerous to workers. Chemical workers, however, tend to believe that risks in the workplace have declined in recent years and that employers are making a bona fide attempt to improve occupational health and safety, especially insofar as carcinogens are concerned.

At the heart of the debate over occupational safety standards affecting exposure to carcinogens is the issue of levels of exposure. On the one hand, some argue that because the level at which biologically active compounds cause cancer is not known, any exposure to such compounds should be eliminated. On the other hand, others contend that such a "zero exposure" standard is both unreasonably stringent and economically too costly, so that more realistic standards should be set.

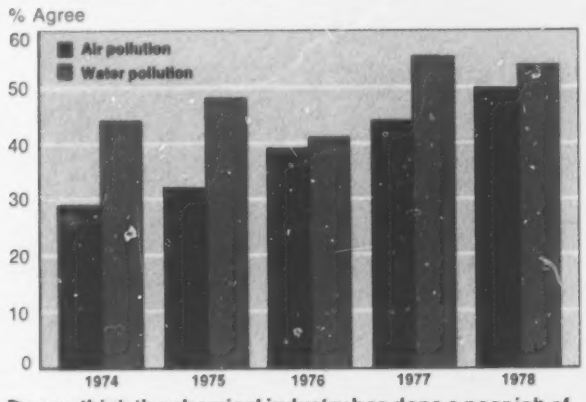
Given a choice of exposure standards, only about a quarter of the public and a sixth of chemical workers want zero exposure; 40% of the public and 55% of chemical workers would accept a reduction of exposure only to the level achievable with current technology. Indeed, 60% of the public and 81% of chemical workers interviewed in the 1978 study believe zero exposure is not possible.

It is frequently asserted that if consumers only knew the costs of regulation, they would oppose attempts to regulate industry. Therefore, public and worker understanding of the cost consequences of health and safety standards was examined in the 1978 study. About two thirds of both the public and chemical workers understands that the cost of implementing new health and safety standards is passed on to consumers in the form of higher product prices. Nevertheless, about the same proportion of both groups would accept higher prices to eliminate cancer risks.

There is no question that the chemical workplace is filled with potential hazards, such as scalding or corrosive liquids, irritating or toxic gases, and poisonous dusts. To protect workers from these substances, the chemical industry has adopted a number of effective safeguards. Equipment is designed to minimize the exposure of workers to the materials or vapors they contain. Protective gloves, clothing, masks, and goggles are provided in areas where exposure is likely. Most important of all, workers are trained in safety precautions, in the proper use of plant equipment, and in the use of protective clothing and equipment. Moreover, the use of such precautions and protective gear is required by plant rules, enforced by plant foremen, and supported by frequent retraining.

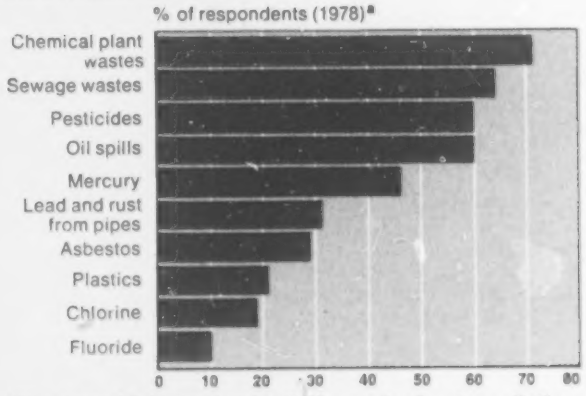
Nevertheless, a substantial question exists over whether the primary responsibility for protection of workers lies with the worker or with the employer. Central to the argument is the question of exposure standards. If responsibility for worker safety lies with the employer, then equipment must be designed and in-

Public is more critical of chemical industry compliance with pollution standards...



Do you think the chemical industry has done a poor job of observing laws and guidelines on air or water pollution?

...and thinks wastes from chemical plants are most hazardous water pollutant



When you think about potential hazards of water pollution, which pollutants do you think are the biggest?

a Respondents could select more than one pollutant. **Source:** Yankelovich, Skelly & White Inc.

stalled that reduces exposure to virtually zero levels. On the other hand, if responsibility lies with the worker, he or she can share in reducing exposure to potentially harmful chemicals by wearing protective clothing.

In the 1978 study, both public and worker samples overwhelmingly agreed that the employer bears the principal responsibility for protection of plant workers; only about a fifth of each group believed primary responsibility lies with the worker.

Even so, chemical workers in discussing plant safety frequently express the view that information on hazards is the key to worker safety. Workers contend that if potentially hazardous substances in the plant are adequately labeled, they themselves can take adequate precautions. The 1978 study, for example, indicates that a majority of the public and two thirds of the workers agree that, with appropriate labeling, responsibility for protection also lies with the worker.

Both of these issues involve trade-offs between worker safety and employer costs. Central to the debate is the question of who should decide how those trade-offs should be made. A variety of options are available. Since the workplace is under the control of the employer, the employer is one of those who can make the decision. Other potential decision makers are labor unions, the workers themselves, or federal and state agencies. Letting a government agency make the decision is the option selected by about a third of the public; workers' selections are about equally divided among business, business with labor unions, and a government agency. However, no very clear preference emerges. Indeed, 43% of the general public and 49% of the workers prefer that business participate, at least to some extent, in the decision regarding trade-offs between cost and safety.

It is evident, therefore, that both the public and chemical workers believe that responsibility for the safety of individual workers lies with the employer. There is less consensus whether that responsibility can be met by providing plants and equipment that minimize exposure or by clearly labeling hazardous material so that workers can don protective clothing and equipment. Accordingly, one could expect that both expedients will be examined.

The chemical industry appears to face growing problems in the national debate over cancer policy. On the other hand, it seems unlikely that press coverage of cancer issues, which has been increasing during the past decade, will abate. In such coverage, the chemical industry is rarely, if ever, shown in a favorable light.

The public has come to see chemicals and the chemical industry as threatening its health and the health of its posterity. To the extent such views continue, it is reasonable to predict that legislation and regulations imposing adverse and, perhaps, unreasonable performance standards on the industry's products and behavior will continue.

Against such a dark future, a ray of hope can be found. There also seems to be strong support for the chemical industry among its labor force. More than 1 million workers are employed in the chemical and allied products industry. This is a potentially powerful constituency for the industry in the coming debate about cancer policy.

It is likely that the debate will occupy the attention of policy makers, particularly public-interest groups, and the public itself for much of the coming decade. How well the chemical industry fares in this debate will depend not only on how well it controls pollution and workplace hazards, but also on how well it is perceived to control them. How successfully the chemical industry will avoid further imposition of onerous and excessive regulation will depend on how well it is represented in the debate by its constituencies. □

Rene D. Zentner is manager of Shell Oil's corporate studies department, which conducts surveys and does market research to improve the quality of Shell's decisions. He previously had held positions in Shell's patent and licensing organization, its transportation and supplies organization, and its planning and economics group. Zentner was graduated from Stanford University in 1944 with a degree in engineering chemistry and received a law degree from the University of California, Berkeley, in 1957. Prior to joining Shell, he worked for Du Pont, a San Francisco law firm, and Tracerlab. He has written extensively on legal and technical subjects. At present, also, he is adjunct associate professor at the Bates College of Law of the University of Houston.